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ABSTRACT

Reporting on the develcpment, design, and implementation of an approach for teaching reading to rural black children in the intermediate grades, this paper is organized in three sections that reflect the framework of the project. The first section discusses the delineation of the theoretical framework for teaching reading, resulting in a rationale comprised of seven basic premises about child development, cognitive development, and reading as a cognitive process. The second section reviews and interprets the literature and educational theory associated with these seven premises, focusing on the ideas of educational theorists like Piaget who have proposed some type of information processing model of the mind. The third section is an overview of the classroom program, illustrating how phenomena within the everyday life experience of the child can become the reading content for an intermediate grade "environmental reading program." (RL)

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READING THE ENVIRONMENT: AN APPROACH TO LANGUAGE AND CONCEPT DEVELOPMENT

by Arlene Marturano

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STATEMENT OF THE PROBLEM

Teaching as a rational pursuit requires that the teacher continually examine, clarify, develop, and synthesize the ideas supporting classroom practice. Developing a reasoned approach to teaching is an evolving task and challenge for every teacher. Without an explicit theoretical framework teachers cannot reflect on or evaluate what they do.

The purpose of the present study was to make explicit the rationale and teaching strategies for a teaching model appropriate to the elementary school. The framing of the model involved three tasks: (1) the delineation of the theoretical framework for teaching, (2) the application of the theory into practice, more specifically, the development of lesson ideas and teaching methodology and selection of appropriate curriculum content, and (3) implementation and refinement of the methodology in a rural Black school in South Carolina.

Learning to read was a major difficulty facing children in the school. By fifth grade a majority of students were reading two years below grade level and many were considered non-readers. Accompanying problems pertained to acquiring information since the reading of printed materials was assumed to be the primary source of information and the reading of textbooks the primary mode of instruction. Short term and long term retention of information was a concern of teachers for it seemed that children could not remember information told to them or read by them from day to day. The hope for continuity in concept development over the course of the school year seemed diminished by an apparent lack of facility with information processing.

Faced with the problem of teaching non-readers and poor readers at the intermediate grade level, the author speculated that perhaps the representational mode and level of instruction created or revealed a representational mismatch for children learning to read. A representational mismatch is a discrepancy between how the child learns and the demands of the learning task. A breakdown in information processing results. Language is an abstract representation. In learning to read the meaning referent may not be clear to the child or the child may not realize that language is representative of phenomena and

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contexts being written about. The ability to deal with and to make representations is central to language and concept development. Sigel notes that:

> Representations are distal from the world of the senses. They are not intrinsic to the object or the event, not a depiction of reality—in time, space, or content. The child has to learn that the representation is a mode of depicting instances of the physical and social world--modes which are distinct from their referent (38:69).

How does the child learn that the world of print is a representation or that the three-dimensional world is being, has been, and can be translated into representations? At school the child encounters a plethora of representational materials. Sigel notes:

> Representations are acquired initially and perhaps all through life in the course of interactions with three-dimensional reality.
>
> . . . . . .
>
> How man thinks, what man remembers, what man perceives, what man does with the knowledge that he acquires are derivatives of and dependent on man's basic capacity to represent the world mentally. We tend to take for granted that ability to deal with the world representationally is a "given" (38:60-61).

Sigel's work suggests that a child does not "naturally" respond to representations but rather learns to deal competently with representational material only by having experiences that demand he transform the three-dimensional world into various modes of representation. Sigel's distancing hypothesis confronts the problem of the process and conditions for transforming the three-dimensional environment into mental representations. He argues:

> . . . the development of representational thinking is fostered by those life experiences which create temporal, spatial, and psychological distance between the self and the object. Distancing was proposed as the construct defining those classes of behaviors or events which function to separate the individual from the immediate behavioral environment. For example, asking a child to reconstruct a previous experience poses a challenge to the child to bring awareness of previous experiences. Thus, the child separates or distances himself at that moment from the present in order to reconstruct the past. The child is responding to the distancing behavior, to the request to re-present previous experience through separating the self mentally from the here and now (39:166).

The ideas of "demand" and "require" are important features of the distancing hypothesis for instruction. Sigel indicates:

> The behaviors or events in question are those which require the child to attend to or react in terms of the nonpresent (future/past) or the nonpalpable (abstract language) (38:69-70).

Furthermore, he states:

> . . . the condition which activates the organism to respond possesses demand characteristics . . . representational thought is a cognitive response to a psychological demand (39:170).

For learning to occur the environment must place certain distancing demands upon the learner. Sigel defines distancing as

> . . . a demand feature of environmental events which serves to stimulate, activate, and energize organismic capabilities to represent experiences. The representation is achieved through reconstructing, anticipating, or integrating experiences in the immediate present (39:167).

What are the significant distancing behaviors identified by Sigel? Teaching strategies that involve the child in inquiry guided by focused questions; inquiry activating mental operations or the skills of representation, e.g., observing, describing, comparing, classifying, sequencing, inferring, generalizing, and planning; and activities that require the child to transform the three-dimensional environment in a variety of representational modes, e.g., language, drawing, model building, and action modes, are presently being employed in Sigel's experimental preschool at Educational Testing Service. The content and the structure of the linguistic environment, in particular, the teacher's language, is considered a crucial variable of instruction. Sigel believes:

> The content of the linguistic environment must contain a high frequency of words referring to distance in time or space and to past, present, and future to create psychological distance between reality and its reconstruction . . . Language is the tool or the vehicle by which objects and events can be distanced, and the linguistic environment must provide the models (38:73-74).

The language models provided by the teacher are necessary but not sufficient conditions for learning. The environment must provide opportunities for verbal interaction between the models and the child and deliberately plan distancing demands for the child to articulate his own experience. Meanings are developed as the child responds to experiences by transforming them symbolically. Language without experience is meaningless; experience without language is lost.

Sigel's work suggests the need to develop a teaching model for elementary education employing distancing behaviors in a learning situation that uses the immediate context or three-dimensional environment as the starting point for representational activities that develop language and concepts. Yet the question remains: What is the relationship between representation and reading? Representation as described by Sigel is fundamental to the development of thought and the conservation of meanings. To re-present is to transform

experience into mental or symbolic forms, e.g., action, pictures, images, and language. The serious literature on the reading process has long emphasized that the three-dimensional environment is the child's first and most fundamental source of meaning. The meaning of reading in its broadest sense is that of an active mental process of language and concept development via experiences. Burton's definition of reading illustrates the kinship between representation and reading. He states that "Reading in the broadest sense is the development of meanings in response to stimuli and for the purpose of guiding behavior" (11:15). Burton makes the distinction between reading in the broadest sense which includes the reading of things, persons, and situations as well as printed materials and reading in its limited sense which includes only the reading of printed material. Burton's broad definition of reading qualifies reading as a general distancing behavior since reading is viewed as the development of meanings in response to environmental experinces. Reading is not getting meaning from stimuli but rather bringing meaning to and developing meaning from environmental cues. An individual's concept repertoire or environmental code will influence the process of reading. Since representation is fundamental to the development of concepts, representational competence affects one's reading ability.

Reading as the interpretation of the environment requires the individual to represent the environment. Interpreting is a representational skill.

Considering the implications of the above ideas for instruction in the context of the rural Black school, one might conclude that reading of the three-dimensional or immediate surroundings is a prerequisite for reading printed materials and that as the child learns to represent the immediate in a variety of modes he is acquiring representational competence and requisite meanings for approaching printed material.

The speculation suggesting a representational mismatch between the way the child learns and the demands of the reading task has received little deliberate attention in basal reading series' rationales. That a teaching methodology can be designed to create a match between the child's environmental code and the demands of the reading task was the direction taken in the present study.

A number of observations were made about children from the rural setting which seemed to offer evidence of a representational mismatch. One observation was the preoccupation with the tangible or immediate character of experience.

Children could not retain information detached from the immediate. Furthermore, the cultural environment had not demanded thought or action beyond the present. Sigel also found that "lower class Black children had difficulty in coping with representations in the form of the nonpresent or the inferential or re-presentation of reality" (38:64). He also investigated parent-child interactions and found that in lower class Black families

> . . . few if any of the parent-child interactions involved strategies which were distancing. Techniques of child management, as well as teaching strategies, emphasized the present and the apparent, with little attention for planning or representing anticipated outcomes (39:170).

At school, textbook instruction made no attempt to bridge the gap between the child's personal experience and knowledge construction and established cultural knowledge.

A further observation was that children receiving purely verbal instruction with textbooks had difficulty relating new information to previous knowledge. Difficulty with abstraction was apparent in both oral and written expression. The literature on representation suggests that verbal instruction by itself fails to provide sufficient conditions to active representational thinking.

Too, children experienced difficulty in drawing pictures of objects or events absent from direct view. Mental imagery appeared vague and, in instances, non-existent. Experiences that would develop imagery were missing in instruction at school and home.

The oral and written expression of some of the children offered clues to problems with representing reality in verbal form. Sentences were telegraphic in length and content. Nouns and verbs predominated. Prepositions, conjunctions, articles, and tense endings on verbs and plural endings on nouns were missing in the oral and written language of some of the children. Present tense was the predominant time marker in speech. The significance of language as a distancing vehicle has been observed by Sigel. He cites reports that in the language of lower-class Blacks

> . . . time is represented grammatically in the continuous present--"I does this"--which may refer to the past, present, or future. Clearcut delineation of the three time dimensions is not made; failure to delineate may account for distancing difficulties in this group of children. Time perspective is essential in sequencing events, and ability to sequence contributes representational competence (38:74).

Sigel reasons that a lack of clearcut delineation of time concepts may be a negative factor influencing representational ability. One may speculate that the omission of other parts of speech may also influence the ability to

represent events. For example, the omission of prepositions in speech may mean a failure to delineate position in space. Position is essential to describing events, sequencing events, and perceiving cause-effect relationships. Information processing would be reduced without the use of function words which serve to signal particular features and conditions in the environment and organize and structure that environment symbolically.

To find procedures whereby these children could successfully process and express information was a major challenge. In working to develop a framework for teaching children, the author found the literature on representation to hold much promise for directing practice. Representational competence defined by Sigel as "the ability to deal equivalently and competently with representational material" (38:62) is a function of life experiences. The experiences of the rural Black child may not be expressed or elaborated in forms which extend meanings beyond the immediate context. The challenge for instruction became one of finding a teaching methodology which expanded and elaborated the present experience of the child. The teaching methodology had to reconcile the mismatch existing between the way in which the child learns to represent the world and the task of reading.

An environmental reading methodology, Reading the Environment, was developed and implemented in a self-contained fourth-fifth grade combination classroom for two years and a fifth grade classroom for another two years. Children in each year's classroom ranged in age from nine through twelve. Class sizes varied from twenty-six to thirty-two children per year.

In design this study was philosophical rather than statistical; it aimed to substantiate an approach to teaching and to exemplify how the approach might look in practice. Authority, experience, and argument were the research methods employed.

THE RATIONALE

A set of premises synthesize the theoretical direction; they outline the theory of instruction. The theoretical resources from philosophy, psychology, linguistics, and education that were most useful in synthesizing an approach to teaching will be reviewed.

Premises of the Program

1. The child is an information processing system that collects, stores, retrieves, constructs, and utilizes data to make meaning.
2. The child constructs his view of the world, i.e., knowledge is constructed by the child through encounters with the immediate and mediate environment.
3. The senses are the circuitry of the information processing system.
4. Reading is an active process of inferring meaning from the phenomenal field.
5. Reading the immediate surroundings is a prerequisite for reading printed material or mediate sources.
6. Information processing is conducted through mental or logical operations.
7. Language functions as a signal system for promoting the individual's ability to read meaning from the environment. Language frames are single words or patterns of words which function as signals when reading meaning from the environment.

Review and Interpretation of the Literature

1. The child is an information processing system that collects, stores, retrieves, constructs, and utilizes data to make meaning.

One major theme in educational theory has been the conception of the human mind. Differing concepts of mind have led to differing educational programs and practices.

The differing concepts of mind presented by educational theorists in the past can be examined from a current model of mind in cognitive psychology--the information processing model. The model suggests that the teacher view the learner as "an agent for dealing with information, where information is defined very broadly, we have something more analogous to an electric computer" (23:212). Or, as is suggested by Langer, the learner is a "great transformer of data (26:46).

An examination of the selected literature in educational theory reveals that the concept of the individual as a processor of information has a lengthy

theoretical lineage. The information processing model contains three key themes: "processing" implies an active intellect; "system" implies an organization of information; "to make meaning" implies that knowledge is both a construct and a goal of the individual. This information-processing model distinguishes integrated and mutually dependent phases of the learning process: the data collection phase, a meaning construction phase, a storage phase, a retrieval phase, and a utilization phase (21:31-41).

In the collection phase the individual approaches and gathers data from the environment--sensory information. The collection phase is one of perception. The data of perception are the raw material for the construction phase (41:1).

The construction phase of information processing transforms the sensory information into meanings, concepts, or symbolic forms. Langer describes the process: "The material furnished by the senses is constantly wrought into symbols, which are our elementary ideas" (26:46). The symbolic transformation of the external environment into mental representations of that environment leads to the acquisition of concepts. The construction phase may also be thought of as the interpreting or coding phase. Symbolic transformation codes meanings in action, image, feeling, and language forms (41:1).

Meanings are retained or stored in memory for future use. The storage phase has both short-term memory and long-term or persisting memory storage.

The retrieval phase of information-processing searches and summons stored concepts for use. Stored and dormant concepts become available, accessible, and mobilized for use in learning (21:40).

The utilization phase applied previously learned concepts to new and different contexts. All stored concepts have limitless utilization potential for the ongoing development of meanings. Concepts are utilized as probes for gathering data and as relationship schemes or linking elements for constructing meaning (44:1). Concepts are tools for reasoning.

Teaching methodology is concerned with developing strategies for assisting the child during each phase of information-processing. The teacher designs data collection, construction, storage, retrieval and utilization strategies for children to employ during learning activities.

As stated previously, the history of educational ideas reveals different conceptions of the human mind. We now turn to examine the ideas of educational theorists who have proposed some type of information processing model of mind.

Historically, perhaps the first philosopher to recognize the active nature of mind, the activity of mind to establish a continuity with the present, with one's past, and a projected future, was Aristotle. Aristotle demonstrated a functionalist position in his belief that all in nature including mind had a particular function to realize. The active intellect functioned to know. Aristotle viewed mind as a set of faculties or potential actions. The faculties formed an interdependent system for processing information obtained through sense-perception.

The rational faculty distinguished man from other animals. Aristotle divided the activities of the rational faculty into two forms of reason: theoretical reason and practical reason.

The theoretical level of mind achieved scientific knowledge about the world of plants, animals, air, water, earth, and fire (2:Bk. II, Ch. 1, 192b). Theoretical reason inquired into the causes, composition, structure, and function of phenomena (2:Bk. II, Ch. 3, 194b). A major part of scientific knowledge was knowledge about process and change in the natural and physical world or, in Aristotle's terms, "to study coming-to-be and passing-away" (1:Bk. I, Ch. 1, 314a). Aristotle classified processes into three kinds: the cyclic, epicyclic, and noncyclic.

Because of Aristotle's interests in the natural and physical sciences and his belief that scientific thinking is the highest goal of the individual, one might envision an Aristotelian elementary school curriculum being devoted to the study of natural and physical phenomena with an emphasis on perceiving and explaining change--a school where children are continuously engaged in the study of things "coming-to-be and passing-away" (1:Bk. I, Ch. 1, 314a).

The Environmental Reading Program drew heavily upon natural and physical phenomena as the basis from which to develop the child's reasoning ability. The perception of change in the environment was a major feature of children's ongoing reading. In particular, the study of cycles was a year-long reading activity.

In Locke's information processing model the senses collect information from the surroundings and the operations of mind, e.g., comparing, abstracting, and generalizing, convert the sense experience into knowledge. The faculty of contemplation retains or stores information in the mind. Memory was the faculty with the power to revive or retrieve stored information.

The distinctiveness of Locke's thought is that he introduced the use of induction as a primary way of knowing.

> Knowing is seeing, and, if it be so, it is madness to persuade ourselves that we do so by another man's eyes, let him use never so many words to tell us that what he asserts is very visible. Till we ourselves see it with our own eyes and perceive it by our own understandings, we are as much in the dark and as void of knowledge as before, let us believe any learned author as much as we will (22:86).

Locke's "seeing for oneself" attitude was incorporated into the Environmental Reading Program to build a knowledge base and confidence in one's own powers of observation and inference. The child derives enormous intellectual excitement from comparing his own observations and inferences to those made by authorities.

Rousseau's information processing model introduces physical action as an instructional coordinate of sensory training. Sensori-motor intelligence is implicit in Rousseau's concept of mind:

> The first natural movement of man results from his efforts to cope with all that surrounds him and to investigate the sensory qualities in the various objects which concern himself . . . Since everything that enters into the human comes through the senses, the first reason of man is a reason of the senses. Of this the intellectual reason is based. Our first masters of philosophy are our feet, our hands and our eyes. To put books in place of this experience does not teach us to reason . . . (5:54).

From sense data the mind is led to ideas but Rousseau cautions against prematurely moving from sense data to abstract ideas:

> Let us transform our sensations into ideas, but do not let us leap from objects of the senses to objects of the intellect. It is through the senses that we come to the intellect. The senses must always be our guide in the first operations of mind. The world must be our one book . . . Make your pupil attend to the phenomena of nature (5:72-73).

Reason is developed as the child confronts his own immediate experience.

Rousseau cautioned against presenting the child with representational material in place of the actual or three-dimensional world. He said:

> To teach this child geography you set out to look for globes, spheres and maps. Why all these contrivances? Instead of these representations, begin by showing him the real thing, and let him know at least what you are talking about (5:73).

Kant brought to the foreground a problem confronting every teacher: what contribution does the mind make to perception? Kant's theory of mind emphasized its interpretive nature. Kant argued that while the contents of the mind originate in sense perception, form or organization is imposed on the sense data received.

Kant recognized two faces of mind--the perceptual and the conceptual.

Perception brought an awareness of the phenomenal world; conception brought the meanings and relationships in symbolic form.

The Kantian idea "that percepts without concepts are blind and that concepts without percepts are empty" (37:238) made educators aware that the quality of the child's perceptual encounters was influenced by the conceptual framework or meaning code available and utilized for apprehending the environment. In the contemporary language of information processing Kant's concept of form serves as an important element in collecting, storing, retrieving, constructing, and utilizing ideas. The forms of time, space, and cause, for example, enable the individual to perceive temporal, spatial, and causal sequences from what might otherwise be a smear of sensation. The contents of the mind are stored in forms, e.g., images, concepts, thoughts, ideas, language, representations, which activate and retrieve related forms, i.e., concepts act as linking elements for structuring relationships. Concept formation depends upon increasing the connections among ideas already in the mind. Learning involves perceiving and structuring relationships via forms. The Kantian perspective suggests that concepts are a code for perceiving elements in the environment, i.e., concepts are one's environmental code.

Pestalozzi's educational theory was influenced by the empiricism of Locke and the rationalism of Kant. Pestalozzi viewed mind as receiving sense impressions and actively practicing to analyze, compare, and make ideas with the sense data. Pestalozzi believed that the mind contributed three fundamental forms to experience: language, shape, and number (14:343). The object lesson was designed to train the child to learn via the forms during direct experience. Close observation, verbal describing along with measuring, sketching, counting and grouping objects were activities planned to bring sense perception into knowledge. A Pestalozzian instructional formula might read: Immediate sensory experience plus observation via the language, shape, and number forms yield clear concepts.

Herbart considered mind a field or place where psychological events occurred. The mind or apperceptive mass consisted of a structure of knowledge and experience already gained. New ideas presented to the mind would enter to find unity or connection with ideas already there. Ideas acted as if they were forces searching for contact and connection with similar ideas. The structure of mind or mental organization altered as new presentations were assimilated (17).

Another characteristic of the Herbartian concept of mind was the introduction of the conscious and the subconscious zones. Herbart explained that only a small number of ideas could locate in the central focus of the conscious mind at any given time; therefore, the majority of ideas resided in storage in the subconscious zone. However, storage in the subconscious did not imply inactive status. Herbart believed that the ideas which entered the conscious mind but then were pushed into the subconscious remained actively in pursuit of regaining conscious status and tended to associate systematically with similar ideas already held. Ideas carried retrieval tendencies.

Apperception was the process whereby ideas formerly acquired rushed to greet similar ideas presented to the mind. Education was thought of as a process designed to assist the child in relating new ideas to those already acquired and in organizing what he knew. Progress in concept formation and organization was influenced by previous concepts in the apperceptive mass.

In contemporary educational psychology Ausubel extends Herbart's ideas with the concept of advance organizers which seems to be a specific methodology designed to assist the learner to structure relationships between existing cognitive structures and new instructional material (4:105). Ausubel assumes as did Herbart that cognitive structure is a system hierarchically organized in terms of general concepts which subsume less inclusive subconcepts. New ideas entering the cognitive field interact with and are subsumed under a more general concept.

Ausubel's ideas are particularly relevant to the present study. He comments that children who enter school with poor verbal facility and a cognitive structure different from that expected by the school tasks will experience difficulty in processing information. He notes that the lower-class child's difficulties in school are the effects of a curriculum that assumes too much and demands too much (3:408). The school creates a mismatch between the learner's conceptual framework and the demands of the curriculum.

To remedy this situation Ausubel suggests the use of the teaching strategy of advance organizers. Organizers are general frameworks or outlines of familiar ideas and experiences that are introduced in advance of new learning to facilitate information processing. Specifically, the advance organizer strategy assists by mobilizing previously learned material to integrate with new information, by providing a general framework to subsume new details, and by building an anchoring post for future learning (4:113-114).

The present study has adapted some ideas from Herbart and Ausubel. The child's natural rural environment was made the general context for initiating learning. The natural environment provided a secure anchor of familiarity. The hierarchical structure of language, i.e., syntax was employed as one organizer. The child was provided with an environmental code for assisting in information processing. The child viewed as a cognitive classification system focused teaching methodology on assisting the child to perceive and construct relationships. Having the child transform the three-dimensional world into three-dimensional models, two-dimensional graphics, and unidimensional language forms was a measure designed for the conservation of meanings and consolidation of knowledge.

Dewey's theory of mind emphasized that the making, developing, and testing of inferences was the heart of thinking and of learning. Dewey observed that thought did not exist without inference:

> In every case of reflective activity, a person finds himself confronted with a given, present situation from which he has to arrive at, or conclude to, something else that is not present. This process of arriving at an idea of what is absent on the basis of what is at hand is inference (16:95).

Inference places an interpretation on data.

Dewey's analysis of reflective thinking is similar to the contemporary information-processing model. Dewey recognized two factors in all reflective thinking: observation yielding data and inference yielding ideas. One of the instructional problems encountered by children in the rural school was information processing, specifically, seeing the immediate as representative of numerous abstract ideas and relationships. Dewey's account of reflective thinking enables deliberation and planning in that direction. The instructional setting provided empirical situations that initiated thinking, i.e., some thing or event was observed. Data were collected from observation. The data were treated as "evidence of" hidden meaning. From observed data inferences or ideas were formed, i.e., the data were interpreted. The inferences as instrumental ideas were employed to guide future observation, recollection, and experimentation. The fundamental significance of inference rests not merely in the problem-solving episodes that confront the individual but more importantly in its potential for furthering concept development, for extending the individual's construct of the world.

Piaget offers an interpretive theory of mind. The interpretive theory

assumes the mind to be continuously interpreting the environment in an effort to organize reality and, subsequently, to direct behavior. Piaget states: "The essential functions of intelligence [mind] consist in understanding and in inventing, in other words in building up structures by structuring reality" (36:27). Mind is constructing a mental model of the world.

Assimilation is the process of incorporating the data of experience into one's mental framework. Piaget believes that to assimilate data the individual must act on it and transform it in some way. In this way concepts are developed. The transformation of the data is an interpretation of it and results in a modification of the existing framework of thought. The alteration in understanding that results from new information is the process of accommodation. Assimilation and accommodation operating in concert bring about an elaboration and extension of meanings, of schemata.

Piaget's concept of schema is a crucial part of his theory of mind. Assimilation and accommodation yield schemata. A schema is a cognitive structure or psychological organ designed to assimilate the environment. In the language of information processing, a schema is a data structure for representing concepts stored in memory. Schemata exist for "generalized concepts underlying objects, situations, events, sequences of events, actions, and sequences of actions" (37:101). Schemata exist as the concepts of instruction, e.g., the schema of tree, and for processes of thinking or mental operations, e.g., the schema of classifying. Schemata take verbal and non-verbal forms as actions, images, feelings, and language. An individual's schemata constitute his interpretive framework. Ward explains the function of the interpretive framework:

> For anything to be perceived and formed in the mind it must be related to an interpretive framework, a framework of meaning. The knowledge (meaning) that you possess directs, selects, and shapes further meaning for you. Your total interpretive framework is a unique orientation for making meaning. It is a developmental artifact of experience (42:6).

In Piaget's information processing model assimilation is the process of utilizing schemata to interpret the environment and accommodation is the process of modifying or changing schemata. Schemata are mental structures developed from experience for the purpose of interpreting or "reading" the environment. The environment furnishes the aliment for knowledge construction.

Piaget's conception of the individual as an interpreter of his environment influenced the approach to teaching developed in the present study.

Reading the Environment was the name given to the approach. The learner was viewed as an interpreter who approaches the environment with schemata, concepts for reading meaning from the environment. The overall task of instruction was to assist the child in perceiving and structuring his world. Subordinate tasks included formulating strategies to assist the child in searching for and collecting information through his senses, in storing information in various forms for future retrieval and usage, in retrieving available but dormant concepts, and in retrieving, utilizing, and formulating appropriate schemata for interpreting the environment. In general, the information organization and processing strategies were designed to expand the individual's meaning framework by insuring that concept development employed and invented action, image, feeling, and language schemata. Language was used as a major organizer of experiences. The child's interpretive framework was referred to as an environmental code.

To summarize the information processing model for curriculum planning purposes, an instructional formula outlining the process of meaning construction was designed. The formula reads: The immediate environment + close viewing via language frames yield ——→ concept development.

Review and Interpretation of the Literature--continued

2. The child constructs his view of the world, i.e., knowledge is constructed by the child through encounters with the immediate and mediate environment.

The teacher's conception of knowledge is another factor affecting classroom practice. The theory of knowledge consistent with the information processing model and interpretive theory of mind described in the preceding section is that of constructivism or structuralism. Constructivism refers to the process of creating mental structures or representations of the environment. The interpretive mind constructs a model of reality or knowledge of the world. The knowledge acquired is organized or structured.

Piaget has stated that " . . . knowledge is essentially construction" (32:362). Knowledge is constructed by the individual's interactions with objects in the environment. "Intelligence thus begins neither with knowledge of the self nor of things as such but with knowledge of their interactions . . . " (33:400).

A key idea in Piaget's theory is that of the development and schematization of originally overt physical actions, i.e., the progressive transformation of overt physical actions into mental operations and schemata (19:368).

Piaget characterizes general cognitive development as an invariant sequence of stages with each stage building upon the previous: sensorimotor schemata into concrete operational schemata, concrete operational s chemata into formal operational schemata (19:244). The sequence of stages in the development of concepts or thought will be referred to as levels of representation. Piaget identifies the stages, more specifically, with reference to meaning development. The levels of representation are: (1) signals, (2) symbols, and (3) signs, with actual objects and events initiating all meaning development.

Piaget begins an analysis of the levels of representation by observing that meaning development initiates in the phenomenal field of immediate objects and events. The objects and events are signals, indications or evidence of meanings. He notes that to assimilate an object or sensory information is to "insert it in a system of schemata, in other words, to give it 'meaning'" (34:189). At the signal level of representation the child also deals with cues which refer to specific objects. The attributes or characteristics of objects such as color, size, texture, shape, and location are cues to an object's existence, identity, and meaning. The signal may be a concrete object or an event, a sensory impression, or an attribute of or partial evidence of an object.

The symbol level of representation is a psychological step removed from the immediate environment of signals. In Piagetian theory, "a symbol is a translation of reality: The mental image is a symbol of reality" (39:111). A symbol codes a relationship between objects or events and the symbol captures the congruence, e.g., a child's stuffed dog represents an actual dog, a child's painting of a flower represents the flower, a dance or gesture may stand for an actual physical event, imitating natural sounds symbolizes the actual sounds. Piaget explains:

> A "symbol" is an image evoked mentally or a material object intentionally chosen to designate a class of actions or objects. So it is that the mental image of a tree symbolizes in the mind trees in general, a particular tree which the individual remembers, or a certain action pertaining to trees, . . . We shall see it [the symbol] made manifest during the child's second year at the time of the appearance of the symbolic game (the game of make-believe) or when the progress, intelligence and the use of practical deduction will really evoke absent objects (34:191).

The sign level of representation is that of language. Language bears no resemblance to the reality that it represents. Signs are symbols in that they are translations of reality but they are arbitrary symbols whose meanings are

culturally determined. Piaget notes:

> The "sign" moreover, is a collective symbol, and consequently "arbitrary." It also makes its appearance in the second year, with the beginning of language and doubtless in synchronism with the formation of the symbol. Symbol and sign are only the two poles, individual and social, of the same elaboration of meanings (34:191).

Piaget suggests that the sign system of language can function as a signal to meaning as do phenomena. He explains that for meaning to exist there are always a signifier and a signified.

Bruner condenses the Piagetian developmental model of representation. He discusses how a child codes and stores external reality mentally:

> What is meant by representation? What does it mean to translate experience into a model of the world? Let me suggest that there are essentially three ways in which human beings accomplish this feat. The first is through action. We know many things for which we have no imagery and no words, and they are very hard to teach to anybody by the use of either words or diagrams and pictures. . . . There is a second system of representation that depends upon visual or other sensory organization and upon the use of summarizing images. . . . We have come to talk about the first form of representation as <u>enactive</u>, the second as <u>iconic</u>. Iconic representation is principally governed by principles of perceptual organization and by the economical transformations in perceptual organization . . . techniques for filling in, completing, extrapolating . . .
>
> Finally, there is representation in words or language. Its hallmark is that it is <u>symbolic</u> in nature, with certain features of symbolic systems that are only now coming to be understood (8:10-11).

Enactive, iconic, and symbolic representation are a developmental trilogy portraying the sequence of the modes of representation or ways in which the child translates experience: from action to image to language.

How can instruction facilitate the individual's tendency to re-present the three-dimensional environment in symbolic form? Thought or concept development is a central goal of instruction. The teacher needs an awareness of strategies which foster the development of representational thought.

Sigel recognized the methodological dilemma and proposed to locate

> . . . the class of behaviors which require the developing child to think in terms of the nonobservable, nonpresent, in terms of symbols and/or signs . . . behaviors used by significant others [parents and teachers] which require the child to separate self from ongoing present to create mental representations of physical, social, and personal reality. We shall refer to this class of behaviors as <u>distancing behaviors</u>. . . . (39:162).

At times Sigel refers to the class of behaviors in more general terms of "life

experiences which create temporal, spatial, and psychological distance between the self and object" (39:166).

Sigel makes a distinction between distancing behaviors and distal stimuli.

> Distance is expressed in the stimuli themselves. For example, a cutout picture of a chair is closer to the chair, or less distal, than is the word "chair," simply because the latter contains no overlap of any kind with the actual reality of the chair. A photograph may be more distal than the cutout, since the cutout contains some notion of dimension or depth in its physical form, whereas the picture (photograph) only represents depth through particular visual cues. The term "distal" will be used to refer to the distance within the domain of the stimuli. Distancing refers to acts or events which may or may not employ distal stimuli to create the separation or differentiation between self and the physical environment. . . . Be it the image, the picture, the symbol, or the sign, each one is different in varying degrees from its referent.
>
> . . . . . .
>
> The distance may be <u>temporal</u>, as between a past event and a present recall; <u>spatial</u>, as with a picture or image and the pictured or imaged; in its <u>modality</u>, the name and the object; or in <u>degree of detail</u>, a sketch of an object and the object itself (38:70-71).

Piaget states that a child's response to stimuli is an interaction between subject and object, and "responses may be serialized in order of genetic succession, based on the increasing distances, spatial and temporal, that characterize the increasingly complex routes followed by these interactions" (35:121).

Herein lies a clue that instruction may deliberately serialize the distancing demands to accord with their natural or genetic development, from action to image to language, thereby minimizing the problem of representational mismatch during instruction. Or, as Flavell interprets the instructional implications of Piaget's theory:

> The teacher should assist this internalization and schematization process in the classroom by getting the student to perform the requisite action with progressively less and less direct support from the external givens. For example, one might begin by having the child operate directly on physical entities, then on pictorial representations of these entities, then have him proceed to cognitive anticipations and retrospections of operations not actually being performed at the moment, and soon, until the originally external actions can take place internally and in complete autonomy from the environment. In other words, the developmental process which occurs in the macrocosm of the child's daily life should be reproduced in so far as possible in the microcosm of the classroom (19:368-369).

Sigel identifies the employment of logical operations in guided inquiry as appropriate distancing strategies. Observing, describing, comparing,

classifying, inferring make mental demands upon the child to process and organize information (39:179). Observation and description strategies require the child to operate directly with the external givens but the operations of comparing, classifying, inferring, etc. move him beyond the information given.

In addition to the theoretical impetus given the search for distancing behaviors, Sigel located empirical evidence that further guided his efforts. The particular problems observed by Sigel relating to children's representational ability are pertinent to the present study. Sigel had been performing object and picture classification tests with middle- and lower-class black and white children. His findings report that

> middle-class children (black or white) tended to classify objects and pictures equivalently and provided reasons for their groupings. Lower-class children, particularly black children, while able to group three-dimensional objects, consequently did poorly on the PCT [Picture Categorization Test] (39:163-164).

Since these same children were able to label the objects and pictures correctly, Sigel concluded that "discrimination of distinctive cues and employing the correct label was not at issue. The issue was clearly the discrepancy in performance between the picture task and the three-dimensional task" (39:164). Researchers previous to this had ignored the possibility that either the level or mode of representation of the task had any bearing on the child's response. Sigel concluded differently after analyzing the demands of the situations. In both the Object Categorization Test and the Picture Categorization Test

> . . . the child is asked to search for one or more criteria by which to to group the items. The child is free to select from among any of the objects as well as to make personal decisions as to the criteria to use, color, form, function, or another. In the OCT tactile test, visual and spatial cues are available allowing direct action on the objects. Piaget argues that "the child acts on objects, but the knowledge he gains is not derived from these objects; it is derived from the action bearing on the objects, which is not the same at all." This physical action precedes internalized mental actions--an invariant sequence as prelude to logico-mathematical thought. Classification is an instance of this thought. Pictures as representations do not allow for these actions, rather classification of pictures requires internalized actions (39:164).

Sigel reasons that

> The child from a poverty level background may not have internalized the actions, and hence is less able to categorize the pictorial stimuli. Apparently, the meaning and subsequent class membership attributed to an object and its pictorial representation are a function of the way it is represented (39:164).

After finding evidence in art education which also suggests that pictures pose comprehension problems, Sigel questioned

> . . . why when the child labels the picture correctly, does the child not react to the picture as an instance of a class? Thus the picture of a horse is not classified in the category "animal" which a three-dimensional representation of the horse might be (39:166).

The ability to conserve meaning despite a change in the mode of representation was lacking. The children lacked representational competence, i.e., "the ability to deal competently and equivalently with representational material" (38:62).

The reading problems of the rural black children in the present study were characterized as problems of representational competence. The author viewed the problems associated with representation cited by Sigel as evidence of a representational mismatch between the child's cognitive framework and the demands of the learning task. Assuming that the child has not internalized the actions for the skills of representation, e.g., for classifying, comparing, inferring, then he lacks the schemata for processing information. If a picture poses comprehension problems, then one would expect a more distant representation, the verbal sign, to do so as well. When confronted with the stimuli of signs as in traditional reading instruction, the child may not understand that a meaning referent exists and that words are representative of phenomena, situations, and ideas.

The instructional problem of building representational competence was approached with two guiding questions. First, how does the child come to learn that external representations such as models, pictures, and words in books <u>are</u> representations? The instructional answer was that the child learns to conserve meanings by translating experience into a variety of external representational forms. The child should engage in imitating phenomena with his body, building models of the actual, painting, and photographing the actual, and languaging his experiences with the actual. The child needs the opportunity to create representational material rather than merely being immersed and confronted with the usual plethora of representational materials found in schools.

Through such activities the child learns

> . . . that objects and events can be represented in different modalities. This is crucial to the development of symbolic behaviors. For without knowing this, the child is not able to respond in appropriate and relevant terms. To know that a picture represents a concrete referent means that the child may deal with the picture in ways consonant with the object (39:173-174).

Likewise, if a child realizes that words represent meanings derived from environmental situations, he may operate with verbal signs in information processing as he would with actual objects.

Sigel suggests that schools should

> . . . reduce the preponderance of representational materials and increase the availability of non-representational items. In this way the children would be more challenged to invent and to discover. The argument is that too high a load of representational materials may decrease the child's need to invent new ways of thinking about objects. Boards and blocks, for example, can stimulate more representational constructions, representations re-presented in the child's internal state rather than the dependence on external representation, such as a toy truck (39:181-182).

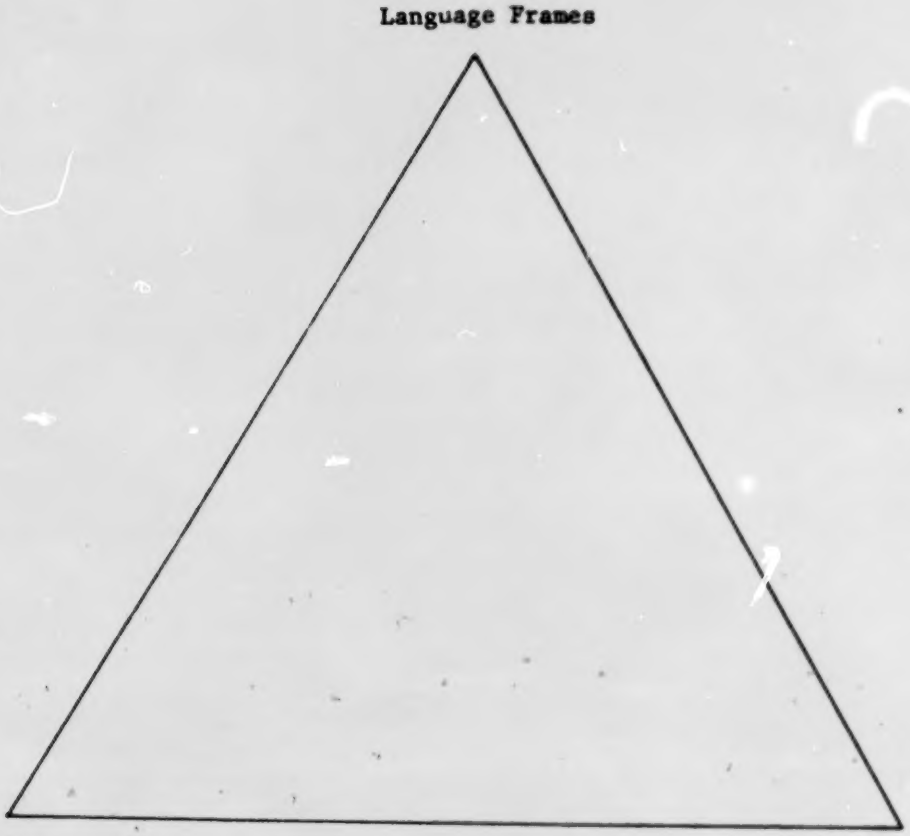
On the basis of Piaget's theory and Sigel's extension of it, one might conclude that the basal reading programs, the standard textbook curricula, and the surfeit of audio-visual aids in contemporary schools amount to information processing overloads for children lacking requisite cognitive schemata gained from sensori-motor experiences. Sensori-motor experiences are not the starting point of instruction in most elementary schools.

The second guiding question is closely related to the first: How can instruction augment the developmental process of representation? The Piagetian view holds that representation is a function of an interpretive mind that continuously reads the environment. From a Reading the Environment perspective, the child reads or constructs meaning from the physical and social environment through interpretive schemata or an environmental code. The logical operations coded in language frames are one significant interpretive schema for representational competence. The concept of language frames will be treated in a future section of this chapter. Suffice it to say that language frames are operational terms for the skills of representation, the reading skills.

Since knowledge construction is a developmental process, we find the child interpreting the environment in different modes or forms at different stages along a distancing continuum. Piaget suggests the stages are an invariant sequence which implies that certain forms of representation precede others, specifically, the child interprets the environment in the developmental sequence moving from action to image to language. In light of the present study's orientation to reading, representation may be thought of as a process of coding the environment in external visible expressive forms and internal operational mental forms--feelings, actions, images, and language.

Diagram I

Basic Components for Concept Development

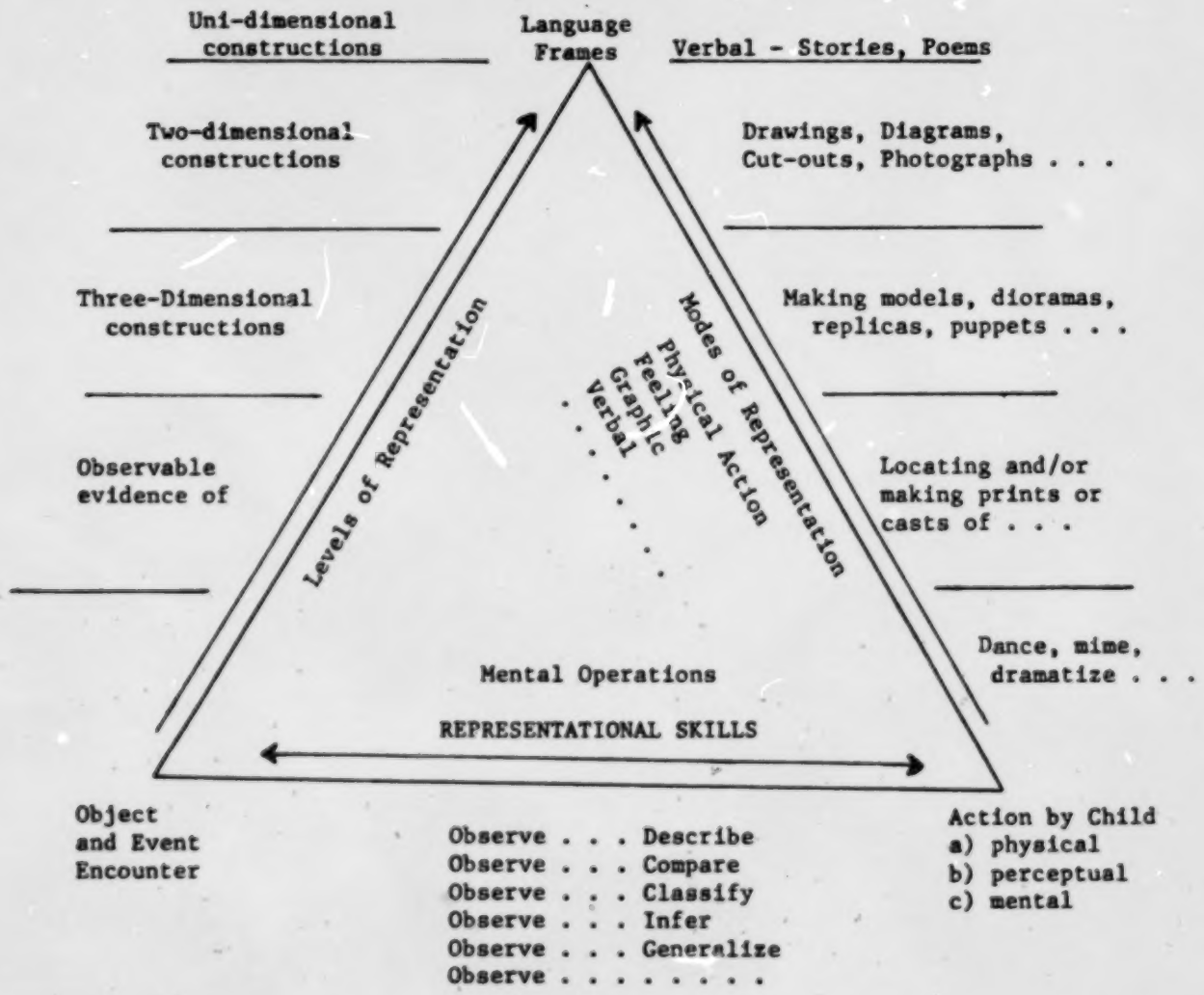


Formula for Making Meaning:

The immediate environment + close viewing via language frames yield concept development

Diagram II

A Diagram for Curriculum Planning Designed to Foster Representational Skills



Since knowledge construction starts from an action-reaction base in the environment, reading instruction begins there as well. Diagram I outlines the components of the basic reading plan used with children in the rural school setting. The three basic components for initiating representational activities or knowledge construction are: objects and events in the child's immediate surroundings, actions performed by the child with the objects and events, and language frames to capture the child's interpretation of the experiences. The actions performed on objects and events may be physical as when the child learns some properties of water while pouring water; perceptual actions such as observing and describing the feel or sound of water followed by making a fingerpainting of water; and mental action as occurs when the child infers the water cycle after observing evaporation and precipitation in the natural environment and through experimental simulation. Since language is a major organizing schema, language frames are employed to capture each kind of action experience. The child pouring water may be asked to employ the frame "When I pour water from the pitcher into the tub, I see _____." The child's observations and descriptions of the feel and sound of water may be captured with the frames "the water feels like _____" and "the water sounds like _____." Such frames also initiate the mental action of comparing. The child must think of objects not present that are comparable to the feel and sound of the water substance which is present. The child engaged in mental activity about water may be led to infer that "water is a recyclable resource" after conducting observations and experiments with water in its various states guided by the language frame series: "It is _____, It was _____, It could become _____." Printing the child's verbal responses on paper for him to see and refer to is a necessary part of developing representational competence.

Diagram II maps an instructional model for deliberately incorporating distancing behaviors and demands into a reading program. Building upon the three basic components of knowledge construction outlined in Diagram I, Diagram II fills in the steps for assisting the child to represent the environment in symbolic forms.

The baseline of the triangle refers to the representational skills or logical operations required for information processing. The bi-directional arrow above the baseline specifies the interactions between the child and the environment. The representational skills are specific instructional interactions through which the child interprets experience. The representational

skills are the thinking or reading skills of observing, describing, comparing, classifying, inferring, etc. Language frames are the operational terms for these mental operations. Knowledge construction begins from an observation and descriptive base from which inferences are made and tested.

Levels of representation refer to the Piagetian sequence of stages in the development of representational thinking: from direct experience, to evidence of the actual, to symbols that bear some resemblance to the actual such as three-dimensional models or two-dimensional pictures of the actual, and finally to the sign level of language. The levels of representation specify the sequence for encounter with representational material as well as the sequence for constructing re-presentations of the actual.

Modes of representation are specific ways in which the child translates experience in the Environmental Reading Program. These are explicit external representations constructed by the child and are his expressions of internal processes. The modes are sequenced so that each level of activity requires the child to construct a representation more distal than the previous. The teaching sequence begins by engaging the child in sensori-motor reading activities with phenomena, i.e., the child acts on objects and receives feedback from them. A next step in distancing would be for the child to act like the object under study, i.e., representation through bodily action. A step removed from the actual might be to find or make evidence of the actual which could be used to signal or remind the child of the actual. By making prints, casts, or rubbings the child sees a representation of the actual. Constructing three-dimensional models and then two-dimensional forms enables the child to symbolize the actual prior to conducting extended verbal discourse about the meaning of the actual in a different form. The uni-directional arrows that move up the sides of the triangle denote that the direction of instruction is always from a sensory or experiential base to the representation of experience.

A prototypic lesson employing the model involves: (1) summoning the child's previous and current experience that relates to each new encounter in the environment; (2) employing distancing strategies, specifically language frames, to activate representation and reorganization of new information; and (3) requiring the child to transform knowledge into a variety of expressive forms (39:184).

Review and Interpretation of the Literature--continued

3. The senses are the circuitry of the information processing system.

The information processing model of mind outlined in the first part of this paper assumed that perception of the environment requires sense receptors or sense modalities to receive data. The collection phase of information processing is essentially the employment of the senses, individually and in concert, to gather and select data for future processing and constructing. Perception is viewed as an interpretive process since what is seen, heard, smelled, felt, or tasted is in terms of what is known, i.e., perception is a function of one's environmental code. One's environmental code assures continuity of perception. Moreover, since perception supplies data for knowledge construction, it is a process which promotes its own ability to function. Perception invests in its future.

Each theory of mind reviewed earlier acknowledged that the individual's mental life was contingent upon the senses and sensory information. Each theory included a theory of perception. A brief resume of each theorist's position on these will clarify the significance of the senses in information processing. How the teacher views perception in relation to cognition will affect curriculum and methodology. Many of the theorists' ideas on perception influenced the curriculum and methodology of the Environmental Reading Program.

According to Aristotle the chief import of perception was that it supplied the primary premises for scientific knowledge. Since Aristotle believed man to be sight oriented, one might assume that a basic perceptual activity in an Aristotelian school would have been continuous observation in residence with nature.

Locke viewed perception as the first faculty of the mind exercised toward knowledge and as "the inlet of all knowledge in our minds" (29:63). All knowledge is derived from experience. Perception furnishes the mind with simple ideas which serve as raw material for the mind to construct complex ideas.

Rousseau considered the senses as the entranceway to reason. Experience was the only teacher of the child. "Since everything that enters into human understanding comes through the senses, the first reason of man is a reason of the senses" (5:54). In the experimental schools influenced by Rousseau's ideas, physical activity was coordinated with sensory experience through nature study, outdoor gardening, and outdoor excursions for the study of geography and local history (14:326). Similar excursions were made by children in the Environmental Reading Program.

Kant introduced the idea of active perception. Perception was an active

function which scanned, selected, and gathered sense data through the interpretive framework of the individual.

Pestalozzi's object lesson was a concentrated application of the Kantian notion of interpreted experience. The child observed phenomena through the forms of language, number, and shape. The use of forms focused and guided observation. By closely examining and describing objects, the child was guided to define the object, thereby placing it in a class of objects. The child drew the objects in an effort to force accurate observation. Reading the Environment revived the use of the object lesson to promote concept development.

The Kantian influence on Herbart's thinking is seen in the theory of apperception. Herbart explained that the individual builds experience from presentations that enter experience through the nervous system.

> Out of the impressions of sense, pain, and pleasure come derived presentations. Those presentations which reflect the idea or thing that caused them, by comparison, abstraction, and generalization, develop into concepts (indirect sensuous presentations) (6:131).

These concepts formed the individual's apperceptive mass or conceptual framework which, in turn, determined entry of new perceptions. Concepts rushed to greet new related perceptions. Perception was not merely a matter of possessing sense organs but required a backlog of experiences, most of which were sublimated in the subconscious. The subconscious added an element of the unexpected to perception for both the learner and the teacher. Followers of Herbart believed that education directed the process of perception through selection of appropriate presentations and employment of a teaching methodology that assisted the child to systematically connect his concepts to new experiences.

Dewey believed that perception supplied the particulars for knowing and intellectual growth. But he reminded that the particulars were noticed and interpreted due to the past experience of the learner. The senses and reason operate in unison to reorganize experience (15:343). Knowledge as past experience serves as the "working capital" for future perception and learning (15:158).

> "Reason" is just the ability to bring the subject matter of prior experience to bear to perceive the significance of the subject matter of a new experience. A person is reasonable in the degree in which he is habitually open to seeing an event which immediately strikes his senses not as an isolated thing but in its connection with the common experience of mankind (15:343).

Perception contributes to constructing relationships.

In Dewey's school, observation moved the child from the immediate to the non-present. For example, during the study of colonial history, children studied the local government as a means of understanding the past. Children collected resources in their surroundings to reconstruct the past. Plants were collected, dried, and used to make dyes. Animal fat was used to make soap. Grasses were used in basketmaking and weaving. Herbs were collected as foods and for making medicines. To learn how to read maps of colonial America, children first observed the local school ground and then made a map of the grounds in preparation for understanding early maps of America (31: 176-177). The physically active learner was also perceptually active in observing consecutive activity and conceptually active in inferring meanings about the past and future from the present situation. The inferences made became tools of perception or hypothetical constructs to be tested. According to Dewey, experience gained through the senses becomes a hypothetical construct for controlling the future; action becomes reasonable when guided by prior experience (15:273).

Piaget believes that all experience is interpreted. Perception is an interpretive activity applied to phenomena directly accessible to the senses. Perception as a mode of adaptation to the environment operates as a result of the child's sensori-motor activities. Perceptual knowledge is one kind of physical knowledge. Piaget states: "We call perception that most direct or immediate possible knowledge of a present object in the sensorial field (without affirming, however, that there exists a knowledge which is completely direct or immediate)" (19:232). Piaget asserts that " . . . there does not exist, at any level, direct experience either of the self or the external environment" (34:136).

Some of the characteristics of perception are analogous to those of cognition. Organization is a tendency of perception. Perception, like cognition, is an interpretive activity yielding organizations or forms of knowledge, perceptual schemata. However, while perception takes place in direct contact with the three-dimensional world, cognition need not. Percepts are an elementary form of knowledge used in cognition. Cognition builds a mental world with the raw data of perception. Piaget treats perception as a developmental process arising " . . . as a kind of dependent subsystem within the larger context of an evolving sensory-motor intelligence" (19:232). Perception

is a function of the child's interactions with the environment. "Even at the stage of immediate experience there is always the unavoidable necessity of actions in order to get at the properties of the object" (32:336).

Piaget treats vision as the pivotal sense for the coordination and use of the other senses in gathering information. Vision is the basic sense for the initial phase of knowledge construction--empirical abstraction. Empirical abstraction occurs as the child observes the movement of objects and the changes in objects. Perception, especially visual perception, is a necessary link in the learning cycle and a prerequisite for representational thinking. Perception allied with action comprises the individual's mobilization or orientation to reality.

The Environmental Reading Program characterized the child as a sensory consortium chaired by language, the conceptual probe.

Review and Interpretation of the Literature--continued

4. Reading is an active process of inferring meaning from the phenomenal field.

The definition of reading used in the present study is derived from the interpretive theory of mind. The theory is biological in orientation. The individual as a biological organism has the cognitive need of understanding and inventing. The cognitive need directs the individual to interact with the environment and to create mental organs, schemata, for extending the environment (32:350). Mind is considered to be the function of the individual that organizes external reality into a mental or internal model of the world.

The child is viewed as a reading organism actively engaged in interpreting his environment with schemata from his conceptual framework. In an Environmental Reading Program the child and his concepts are biological coordinates in dialogue with the environment. By contrast, traditional reading programs introduce words in isolation from the child's natural activity. Introduced in isolation both words and books appear as external intrusions on the life of the child rather than natural outgrowths of his own activities in knowledge construction.

If the child is author of his own thought, then from a methodological view it seems reasonable to propose that the first exposure to formal reading be the content of one's own mind. The child's playmaking and dramatic activities are his first storytelling efforts. The narratization of experience through dramatization structures experience for the child. The child's

painting and modeling activities are the illustrations of his world. The child's language formulates his experience in yet another form. Rather than placing a commercial primer before the eyes of the young reader, the teacher would present the child with the readings of his own commerce with the environment, an environmental primer authored and illustrated by the child. In an Environmental Reading Program, the child's information processing activities would lead to bookmaking activities. Childmade books would contain the child's personally constructed knowledge about phenomena. Bookmaking with children should evolve from their observations and inferences in the same way that books have evolved as a cultural artifact. The overemphasis on books from commercial sources in elementary education tends to give the child the impression that knowledge comes primarily from books or an authority other than oneself. The child needs to achieve confidence in his own powers of observation and inference before seeking secondary sources. Bookmaking encourages the organization, storage, examination, and sharing of one's thoughts.

Current definitions of reading tend to limit reading to printed sources. Yet the developmental theory of Piaget suggests that an understanding of verbal signs is an advanced cognitive accomplishment grounded on an everexpanding experiential and conceptual base. Meaning development not only precedes the understanding of signs, but it also is a continuing vocation of the individual so that it is possible for signs to grow in meaning. If meaning development doesn't accompany the use of signs, then reading becomes mere word-calling.

Review and Interpretation of the Literature--continued

5. Reading the immediate surroundings is a prerequisite for reading printed material or mediate sources.

The author believes that two factors contributing to the reading crisis are the narrow concept of reading assumed by most programs and the treatment of readiness as discrete from the experience of reading. One assumption of the compensatory programs has been that they are not bonafide reading programs but rather they are preliminaries or preparatory to the "real" thing. The child is dipped in experience for a year in hopes that he comes out ready to master printed symbols henceforth. What most compensatory reading programs fail to realize is that when a child is expressing an experience in oral language, he has been reading cues from the environment and is reporting his interpretation of the experience!

With an awareness of the natural environmental reading performed by children, teachers at all levels of instruction could deliberately plan to incorporate the reading material in the surroundings as the initial phase of instruction. By building a repertoire of observational data and inferences, the pupil then moves to printed sources that confirm, contradict, or extend his initial readings of the environment. Especially important for the beginning reader is that printed sources be supportive of his cognitive framework, his experiential background. Environmental Reading can build the language and concept repertoire that allows the pupil to approach printed resources with a conceptual confidence not merely reserved for those entering first grade but necessary throughout schooling.

Reading readiness is not a period confined to preschool education but has a cyclic existence that is part of the rhythm of education. Rather than conceive of a linear progression to the reading process as the separation of readiness vs. reading does, reading as a cyclic process illustrates the function of the experiential component in all levels of instruction.

Whitehead's notion that learning has a rhythmic and cyclic character can be adapted to reading instruction. The first phase of the cycle is exploration of objects and events through perception. The second phase is an analysis of observations through the power contained in the syntax of language expressed in oral and written form. The third phase is that of generalization or synthesis where observations are classified into one's general structure of knowledge. In the synthesis phase the student draws conclusions of a general nature either extending former concepts or adding new ones. The synthesis phase leads one back to the exploration phase for with an expanded information base the individual has added power to explore objects and events. The total cycle is but a readiness for future learning (45:29-31).

The following reading cycle methodology was employed in the Environmental Reading Program.

Phenomena are observed and described ⟶
Observations and descriptions are interpreted ⟶
Interpretations are recorded in language, e.g.,
language frames, storywriting, and bookmaking ⟶
Interpretations are recorded in nonlanguage forms,
e.g., photography, drawing, modelmaking, dance ⟶

Personal interpretive forms are shared with classmates and teacher ⟶

Mediate sources lead their interpretations to the present experience, e.g., books, films, filmstrips, resource people ⟶

Observation and description resume within the newly developed framework of knowledge ⟶

Review and Interpretation of the Literature--continued

6. Information processing is conducted through mental or logical operations.

Throughout the history of educational ideas there persists the notion of activities or powers of mind. In the current literature of education the powers of mind are referred to as mental or logical operations. Lavatelli defines logical operations from a Piagetian perspective: "Logical operations refer to ways in which the mind manipulates or deals with data" (40:27). Piaget considers logical operations to be the ways in which the individual organizes reality. Logical operations are relationship schemes which the individual creates and utilizes for interpreting the environment. Classification and seriation are two major relationship schemes for organizing the world. The logical operations are the skills of representation, e.g., observing, describing, sequencing, comparing, and generalizing.

Observers of classroom teaching methods find that teachers continually require students to perform logical operations (40:27). The teacher's directive words request students to summarize, explain, define, describe, and compare. Classroom observers report that teachers tend to focus on the products of the operation, specifically, the correctness of the student's answer. Teachers evaluate the product of thought without giving attention to assisting the student in performing mental operations (40:20). Teachers cannot assume that children have procedures available for logical thinking or that children can develop these procedures naturally or even readily retrieve procedures that may be available.

Piaget recognizes the structural aspect of language as significant in contributing to the growth of logical thinking. He says:

> Both the syntax and the semantics of language involve structures of classification and seriation. That this is true of classification is immediately obvious. All nouns and adjectives divide reality into classes. Insofar as children use words with the same meaning as adults, these may be directly transmitted to them when they learn to talk. In any case, words inevitably force a beginning of classification on the child . . . seriations are sometimes suggested in a language by special grammatical forms like the comparative and the superlative (24:2).

What Piaget's statements suggest is that language contains the signals for the logical operations. The field of logic suggests this as well. Ennis refers to words which signal part-whole relationships, class inclusion, and conditional reasoning as logical operators in that they signal logical operations (18:42).

Langer's discussion of language as a logical system further supports the idea of syntax as containing methodological import for information processing.

> Perhaps the most elaborate structure ever invented for purely representational purposes is the syntactical structure of language. Its content, in itself, is trivial; it is a system of various little sounds, not beautiful and arresting sounds, but rather ridiculous little squeaks and hums and groans. Yet in their arrangement and organization, these noises have such a developed pattern that they constitute a great system, any fragment of which has its logical form, its so-called "grammatical structure." What this structure can represent, is the order and connection of ideas in our mind. Our ideas are not mere fleeting images without definite relations to each other; whenever we are really thinking, not merely dozing in a haze of passive impressionism, our ideas exhibit sequence, arrangement, connection, a definite pattern. . . . There are many ways of combining the elementary notions in our minds, and the commonest, most general of these ways are reflected in the laws of language, which we call syntax. Syntax is simply the logical form of our language, which copies as closely as possible the logical form of our thought. To understand language is to appreciate the analogy between the syntactical construct and the complex of ideas, letting the former function as a representative, or "logical picture," of the latter (25:30-31).

The idea that the structure of language can contribute to the development of thought includes the realization that language contains patterns for acquiring, storing, retrieving, constructing, and utilizing information. The methodological directive stemming from this idea will be examined under the next premises.

Review and Interpretation of the Literature--continued

7. Language functions as a signal system for promoting the individual's ability to read meaning from the environment. Language frames are single words or patterns of words which function as signals when reading meaning from the environment.

The particular perspective regarding the role of language in instruction to be developed in this section centers around the functional concept of language as a signal system and the corollary concept for instruction--language frames. It is hypothesized that language frames serve as the operational terms or instructional signals for the mental operations.

Evidence from Linguistics

One of the major attributes of the English language described by contemporary linguists is that English is a word order language. Word order languages exhibit several important characteristics. One characteristic is that the meaning of a word is primarily a function of the position of the word in an utterance. The position or context influences the meaning of a word and signals the form class to which the word belongs: noun, verb, adjective, or adverb.

A second characteristic of a word order language is that it signals form class. In signaling form class, language classifies individual experiences into categories of experience: things, happenings, and attribute categories such as color, size, and shape. Words are said to mark, determine, or signal particular constructions.

A third characteristic of a word order language is that it signals relationships. The English sentence is a system of relationships. The basic units of a sentence are the subject and verb. This kernel sentence places two form classes in relationship to each other. A word order language has consistent patterns of relationships that exhibit themselves as variations of the basic theme--the kernel sentence.

The three characteristics of a word order language cited above are part of a broader perspective on language offered by contemporary linguists. Fries states: "A language is a code of signals through which various sequences of vocal sounds or speech acts get meaning; it is a code of signals by which messages can be sent from one individual to another" (20:100). Linguists view language as a tool for coding experience. Meanings are functions of recurring patterns of words correlated with recurring patterns of environmental situations. Linguists note that meaning is not "in" words or symbols but rather meaning is made by people using environmental, experiential, and linguistic signals to interpret situations.

Evidence for Sociolinguists

A major contribution from the field of sociolinguistics regarding the function of language in thinking comes via the Whorfian hypothesis of linguistic determinism. Whorf proposed that the structure of perception and thought is determined by the structure of the language one speaks (13:132). Whorf states:

> The background linguistic system of each language is not merely a reproducing instrument for voicing ideas but rather is itself the shaper of ideas, the program and guide for the individual's mental activity, for his analysis of impressions, for his synthesis of his mental stock in trade. Formulation of ideas is not an independent process, strictly rational in the old sense, but is part of a particular grammar and differs, from slightly to greatly, as between different grammars. We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized by our minds--and this means largely by the linguistic systems in our minds. We cut nature up, organize it into concepts, and ascribe significance as we do, largely because we are parties to an agreement to organize it in this way--an agreement that holds through our speech community and is codified in the pattern of our language. The agreement is, of course, an implicit and unstated one, BUT ITS TERMS ARE ABSOLUTELY OBLIGATORY; we cannot talk at all except by subscribing to the organization and classification of data which the agreement decrees (12:106-107).

Although the Whorfian hypothesis has received much criticism, the present concern is to explore the features of the hypothesis which suggest directions for the role of language in instruction. Two features of the hypothesis which appear pertinent to instruction are those which relate to: (1) the words or categories available to the learner for use in reading the environment and (2) the syntax or structure of the language.

Sociolinguists and psychologists suggest that cognitive differences may be differences in category availability (9:308). A category is a concept. A less available category is not necessarily one the individual is unable to form, but is one not customarily summoned for use (9:308). The child's first categories are those learned in the home culture. The culture of the home and the school may not make similar demands on category formation or usage.

Several implications for education emerge. Teachers can assess category availability prior to assuming availability and demanding premature usage. A major function of schooling would seem to be that of assisting the individual to increase the category repertoire for coding experience along with promoting occasions for facilitating the retrieval and utilization of new and dormant categories.

The syntactic side of the Whorfian hypothesis is consistent with ideas in contemporary linguistics. Both descriptive and transformational linguists recognize the patterned nature of the language code and the effect of the patterning on meaning. Whorf notes that:

> Every language is a vast pattern system, different from others, in which are culturally ordained the forms and categories by which the personality not only communicates, but also analyzes nature, notices or neglects types of relationship and phenomena, channels his reasoning, and builds the house of his consciousness (46:252).

The significance of the Whorfian hypothesis can be viewed through the linguistic framework presented previously. Language as a signal system cues particular constructions and meanings and in so doing can cue perception to particular features of the environment. A restatement of the Whorfian hypothesis for classroom teaching strategies might be: The syntax of one's language cues perception and thought. Words and word patterns alert one to objects, events, and the structure of relationships among objects and events that might not be perceived without language.

Bruner's research on the relationship between grammatical structure and conceptual structure has led him to conclude that

> It is the structure of the lexicon and not simply its list of terms that is crucial [to concept development]. . . . we seem to have found an important correspondence between linguistic and conceptual structure. It relates, however, not to words in isolation but to their depth of hierarchical embedding both in language and in thought. This correspondence has to do not with quantitative richness of vocabulary in different domains or with "accessibility" but with the presence or absence of words of a higher order that can be used to integrate different domains of words and objects into hierarchical structures. No matter how rich the vocabulary available to describe a given domain, it is of limited use as an instrument of thought if it is not organized into a hierarchy that can be activated as a whole (10:306).

What is the hierarchy of which Bruner speaks? The kernel sentence and its transformation. Bruner considers the linguists' concept of form class as being the categories of thought derived from experience. He refers to sentence frames or patterns as a hierarchical system for nesting categories. As a psychologist, Bruner assumes that the category and the sentence are not merely features of language but features of cognitive development (10:42).

The concept of form class as used by linguists and Bruner is not unlike the Kantian categories supplied by the mind for the interpretation of experience. Bruner's categories of experience include things (objects), happenings (events), and attributes of objects and events such as color, size, shape, and texture. Bruner observes that attributes serve as signals to concept development since they are employed to go beyond the information given--by inference. A concept as defined by Bruner is a

> network of sign-significate inferences by which one goes beyond a set of observed critical properties exhibited by an object or event to the class identity of the object or event in question, and thence to additional inferences about other unobserved properties of the object or event (9:243).

An adaptation of Bruner's position for instruction would mean that form class signals when embedded in sentence form, i.e., syntax frames, develop descriptions of the environment from which inferences can be made.

Evidence from Psychology

A major concept of Gestalt psychology is the perceptual field or context. Gestalt theory maintains that the organism perceives organized wholes in a bounded field or context. The principle of closure states that closed areas are more stable than unclosed areas and as a result closed areas more readily form figures in perception. Gestalt theory further states that the details of the perceptual field have either a focused or unfocused existence depending upon the intent, mind set, or purpose of the viewer at any given time. Language affects perception by providing a focus to any perceptual field. Language directs the senses to specific attributes of the field. Those attributes which are attended to become the figure in perception; those attributes not included in focus constitute the background. The use of language to achieve focus is analogous to the photographer's adjustment of the lens on his camera to select and delete features of the environment. Language as an adjustable lens focuses and refocuses the perceptual field. In the teaching methodology of the present Reading the Environment approach, the concept of framing the environment with physical frames and with language frames is derived, in part, from Gestalt theory.

In Piaget's theory of intellectual development the concept of "schema" appears pertinent to the concept of language frames as an instructional method. A schema is a framework by which experience is organized (13:36). In Piaget's theory of intelligence, assimiliation and accommodation of information by the organism "always presupposes some sort of quasi-enduring organization or structural system within the organism" (19:52).

By the time the child enters school he has acquired the basic structural system of language. Language can be viewed as a general schema for enabling the individual to organize experience. In particular, language frames are specific organizers for the instructional setting.

Evidence from Child Language Acquisition Research

Individuals who have studied the origin of syntax in children have contributed to an understanding of how language may facilitate instruction. The chief process by which the child learns syntax appears to be the child's induction of the structure modeled by the adult (7). The child processes the adult language into cognitively appropriate form for his own use. By age four most children have learned the basic structure of their home culture's language.

The research on the child's acquisition of syntax suggests that the adult serves as a modeler of syntax for the child. From this natural language learning procedure in the pre-school home setting comes the practice of language modeling in the school setting. One line of reasoning of proponents of language modeling in school is that if the adult's syntax served as a model for the development of syntax for the child, then perhaps the teacher's deliberately planned modeling of syntax could be used to extend and expand the present syntax of the child. Lavatelli comments

> Of paramount importance in accelerating children's acquisition of language is the teacher's consciousness of her role as a modeler of language and her awareness of the syntactic structure of language (27:105).

Modeling began as an instructional procedure for extending and elaborating syntax but modeling was also found to be a procedure for elaborating the child's framework of meaning. Cazden's research suggests that adult modeling procedures that extend the meanings of children's utterances appear to assist in syntax development (47:54).

One contemporary language modeling procedure employs language frames. Language frames are single words or patterns of words which function as close viewing lenses when inferring meaning from objects and events in the surroundings. The learner is really acting as an information processing system which acquires, stores, retrieves, constructs, and utilizes information while employing language frames in all phases of information processing. Thus, it may be regarded in this manner:

Firstly, language brings the three-dimensional environment into psychological existence. The environment is perceived and mapped with language.

Secondly, the frames focus attention on specific attributes or relationships in the phenomenal field. "Texture" as a frame alerts one to a surface and then to a particular attribute of that surface, not "color," "function," or "age" but "texture."

Thirdly, the frames are categories for classifying elements of the environment, thereby organizing information about the world. "The butterfly is an insect" is a frame which enables generalization. Likewise, the frame "The insect is a butterfly" enables specification.

Fourthly, language frames are the operational terms for the skills of thinking, the mental operations (43:4-5). Carroll observes that the concepts for thinking are coded linguistically. He notes that

> . . . concepts of identity, similarity, comparison of magnitudes, spatial position, temporal sequence, causation, and the like--are coded in the lexical and grammatical structure of language (12:111).

Language frames enable the learner not merely to observe but, more importantly, to describe, compare, classify, sequence, infer, generalize, and evaluate via their use. For example, by employing the language pattern "It is _____ rather than _____" when observing phenomena, one is directed to make a comparison; the form requires it. A powerful instructional strategy comes with the realization that all mental operations have an operational vocabulary and syntax. Language frames are open sesame for data gathering and knowledge construction.

THE PRACTICE

The Curriculum Framework

The curriculum framework has been organized so as to reflect the particular concept of the child and concept of reading herein advanced. The framework has two phases: Phase One is the close viewing phase; Phase Two is the relationship phase.

Close Viewing Phase

The close viewing phase is the data collection stage of information processing or knowledge construction. It has been said that observation and description form the basis for knowledge construction. Observation and description are the primary mental operations for data collection.

The interplay of the sensory or perceptual system and the language or conceptual system so crucial to concept development is orchestrated into the teaching methodology. The senses, particularly the eye, are used to collect observable data from objects and events. Language is also employed as a sensory modality for detecting data.

Framing Procedures. To achieve perceptual focus in the close viewing phase, two framing procedures are incorporated into lessons. First, the child must isolate the context for close viewing. This is achieved by physically framing the context with a viewing frame in the same way an art object is framed for presentation. The field of focus is arrested and directed when framed. The child may use a picture frame, a camera view finder, window frames, a magnifying lens or microscope. The context will determine what framing device is selected. An object or area might be outlined or enclosed with twigs, rocks, yarn, rope, or trenches. Natural boundaries such as the bank of pond beds or clusters of wildflowers and man-made boundaries like fences and windows may provide ready-made framed contexts. Whatever the physical devices for framing, the intent is to sharpen focus and delimit the context and content for reading.

The second procedure utilizes language frames. The child reads the context with particular language frames that enable him to observe and describe that context. Whereas the physical frame enhances perceptual focus for observation, the language frame enhances conceptual focus for description. The

basic language frames for description are attribute categories like "color," "size," "shape," "age," "parts," "things," and "happenings."

Mapping Activities. The above framing procedures are accompanied by storage activities which enable the child to record the descriptive data read from the close viewing of phenomena. The storage activities are mapping activities in both the physical and conceptual sense.

Physical mapping activities record data directly on phenomena. They are external activities that foster internal conceptual mapping or storage. For example, a child observing a tree may describe the color of its bark and place the color descriptions on word cards which are attached directly to the bark so that the bark surface becomes a word map of color words. The word map is the verbal representation of the surface. Maps may also be pictorial or numerical representations. Thus, the same bark surface may be sketched and painted to form a pictorial representation of the surface. Or, the child may measure the height and girth of the trunk, the depth of the bark layers and the age of the tree to obtain and record numerical data about the tree; thus a measurement map is made.

The physical mapping is an external and visible record of the child's developing internal conceptual map. The language, pictorial, and measurement maps can call the actual into existence for the child without the presence of the actual. Mapping activities are storage devices designed to establish conservation of meaning between the actual and that which is representative of the actual, the symbolic.

Relationship Phase

The relationship phase is the processing or inferential reading stage of concept formation. Language and concept development depend upon the individual's facility in perceiving and structuring relationships. The child's conceptual framework at any given time provides the background for assimilating new data to the framework. Data is made meaningful by its connection to existing conceptual structure.

There appear to be instructional strategies for facilitating the perception and construction of relationships. Deliberate teaching methodology can be employed to assist the student in making relationships.

Framing Procedures. Just as physical frames were used for data collection, they are a necessary part of the processing stage. The physical frames serve not only to delimit context but also to delimit a particular kind of context, the system. Systems are by definition contexts with objects and

events in relationship. The close viewing of contexts in the data collection phase can lead to the close viewing of systems in the processing phase.

In the data collecting phase language frames were used to activate the mental operations of observation and description. In the relationship phase language frames are employed to operationalize the mental processes that yield relationships--comparing, classifying, generalizing, and sequencing. The mental activity of comparing, for example, relates data in terms of perceived likenesses and differences among observed objects and events.

Mapping Relationships. Emphasis on mapping activities in the relationship phase shifts from a static portrayal of descriptive attributes to a detailed analysis and synthesis of relationships existing in the environment. Whereas the data collecting phase emphasized the existence of objects and events in the surroundings, the relationship phase moves the individual in the direction of establishing the relevance and significance of existing phenomena.

Language mapping moves from single word attribute frames to phrases and expanded syntax patterns that signal relationships between objects and events. For example, the prepositional phrase is a language signal that encourages the perception of position relationships. Or, phrases employing comparatives, e.g., "is shaped like a _____" or "is bigger than _____" direct the child to comparative relationships. Activities which promote the use of language frames signaling verb tense also contribute to the individual's ability to perceive and construct relationships.

Relationships need not only be expressed verbally. They can be expressed in non-verbal statements such as by pictorial mapping in the form of a sketch, graph, or photograph and by physical activity in the form of dance, pantomime, and drama. Often children who experience difficulty in verbal tasks can gradually gain confidence for verbal expression only after many opportunities for non-verbal expression.

Overview of the Classroom Program

The year began with the close viewing of objects and events through such language frames as "color," "shape," "size," "things," and "happening." These language signals remained as part of our year-long observation/description activities. They can be thought of as basic attributes or property signals.

The study of grasses on the schoolground was one of the early close

viewing activities introducing the above language frames. First, grass habitats were lassoed with yarn to establish viewing contexts. After reading grass outdoors, specimens were taken indoors for closer examination with magnifying lenses. Children sketched their specimens and used either chalk or watercolors to add color. Grasses were identified by name using grass identification keys. Grass specimens were used to create a "Grassland Forest" bulletin board upon which children attached the word cards they had made when reading grass outdoors. A grass seed collecting hunt was taken early one morning. Seed dispersal mechanisms were investigated and imitated in dance. Most of the children quite naturally imitated seed flight with their bodies. Back in the classroom, seeds were examined under magnification, and by making slides and projecting each seed's image on a movie screen. The perception of shape of a seed was enhanced by both procedures; children avidly sketched life-sized, magnified, and greatly enlarged pictures for each kind of seed. Bags of seed were hung on the bulletin board for later use as bird feed. Some of each kind of seed was sown indoors for observation of the life cycle of grass. Children toted 24" x 18" drawing paper, sketching pencils, paint, and cardboard easels outdoors to their original grassland habitats to capture the lassoed area in pencil and paint. The large paintings were collated into a giant grass book. Children then wrote stories to accompany the picture book. The finished book was hung in the classroom for all to read.

In February when the broom straw grass was at its best for harvesting, the children cut bundles of the grass, hung them to dry indoors, and used the grass for a variety of Spring projects. Broom-making, once a common rural custom but now only practiced by the elderly in the community, was revitalized as children made brooms for home and classroom use. Grass dolls dressed in calico were made for use in puppet shows. Children experimented with basket-weaving. Wooden weaving looms were built by children who used the grass to weave small rugs, place mats, window shades, and wallhangings. The craft projects were well executed by the children and they derived enormous pleasure in their work.

Insects and spider study naturally flowed from the observation of grass. Study was initiated when each child sewed an insect net in anticipation of taking collecting tours into fields and woods. Reading activities occurred on site before specimens were taken indoors where habitats were prepared and feeding schedules and menus established. Caterpillars, insect eggs, cocoons,

and spider egg sacs were brought into the classroom so that children could attend to spiderlings leaving the egg sacs, butterflies emerging from cocoons, and caterpillars encasing themselves. A large cylindrical nylon toile cage hung from the ceiling to the floor in the classroom building, housing butterflies and moths. Children watched a female luna moth lay hundreds of sticky bead-like eggs on the sides of the net cage, noticed when the tiny green caterpillars began hatching from the eggs, and measured the growth of the caterpillars as they fed on sweet gum leaves. By introducing the language frames, "It is a . . . ," "It was a . . . ," "It could become . . . ," the children were able to lay hold of the concept of cycle. Furthermore, they came to appreciate the power of language in the discovery of cycles. Children chanted "eggs, spiderlings, spider" after finding a female black widow spider with her egg sacs and observing her until the spiderlings hatched and the cycle was complete. To capture this sequence in a mode other than language, cycle bookmaking was initiated. After children had perceived and languaged cycles, they drew their observations on circular discs of paper. Individual discs were joined together by each child to form a personal book that grew larger throughout the year as new cycles were encountered. Additionally, children represented the sequence of each cycle with felt pieces to relive their observations long after the actual had disappeared from view. Mediate sources of information in the form of library books, films, filmstrips, or resource people were used to extend and verify immediate observations and inferences in the insect and subsequent studies.

Outdoor excursions brought many unexpected events that prolonged interest and required additional information from mediate sources. Children happened upon clusters of split insect skeletons attached to pine tree bark and wondered what they were and what had occurred. In searching other tree bark, they found a few adult cicadas still struggling since the previous night to escape from their nymph skeletons and fly to the tree tops. Suddenly, cicada books were in demand in the school library. Children found spiders building webs and watched as some spiders "wrote" in their webs or wrapped trapped insects. Charlotte's Web and Anansi the Spider Man were sought in the library.

Insect galls intrigued the children so they were collected from oak, cherry, and cottonwood trees and goldenrod stalks. The insects emerging from the galls were fed to classroom frogs and toads. Exterior surfaces and interior chambers of the galls were examined, described, and sketched. Ink, dye, tonic, and jewelry were made from them as had been done by early settlers and herbalists.

The relationships between the form and function of insect parts were introduced when children studied legs, eyes, antennae, and palps through pairs of language frames such as "It is a . . . and it is used for . . . ," "What it is . . . and what it does . . . ," or "Can do . . . and can't do . . . ." Form and function relationships were drawn in detailed enlargements of individual parts and then in enlargements of entire bodies showing profiles from the top, underside, front, and side. Paper maché models of insects and spiders were formed in conjunction with these close viewing activities. Models were then used in a puppet show version of James and the Giant Peach by Ronald Dahl, a book with insect characters read to the class daily during insect study.

Insect and spider behavior stories or dramas were created by releasing creatures from their habitats to act individually or to interact with a kin or a child. For example, butterflies were taken from their cages so children could feel the butterfly's hooked feet gripping their skin and could see how the butterfly coils and uncoils a strawlike tongue during feeding. Children were led to infer functions of insect parts as, in this case, children projected how a butterfly uses both hooks and tongue when feeding among flowers. Honey or sugar water solution was fed to the butterflies to observe feeding.

The close viewing of insect behavior was captured by sketching the sequences of an insect's motion on sieries of from twenty to thirty frames of paper. A cricket moving its antennae, a daddy-longlegs apider running, an inch worm walking a stick, a praying mantis turning its head like a pendulum, a butterfly emerging from a cocoon, ants climbing a hill, and a butterfly's tongue coiling and uncoiling were some of the motions sketched. The series of frames for each behavior were stacked together like a deck of cards which, when flipped with the fingers, presented a motion picture of the insect. Flip book production introduced sequence framing for the making of animated cartoons. The class combined all flip books into an 8mm animated film entitled "Insect Behavior."

As children were involved with observing and describing phenomena, their verbal descriptions were placed on index cards or sentence strips and stored in a variety of ways. Children made felt work pockets and envelopes to pin to their clothes; fabric word belts, word aprons, and word suspenders were also made and worn. Since language is as much a part of the self as one's

skin, wearing one's words seemed a natural wardrobe. The practice delighted the children. Printed words gradually became a more comfortable part of the surroundings. Wall word banks, word boxes on desks, string dictionaries, oral chants, and original songs were additional ways of preserving words. Weekly spelling lists were derived from current activities.

Classroom activities were captured through story writing episodes. One way to help children sequence events was to have them reflect upon their own actions. Their actions told a story that was captured in experience charts, in class made books, in photograph albums, in slide-audio scripts, and in personal story folders. Personal story folders recorded weekly events and, when taken home at the end of the school year, represented a diary of the year's events.

Opportunities were made to share stories with classmates by tape recording them for listening sessions, by reading aloud to classmates, by displaying stories on or near activities, by making gameboard story activities and by designing story-trail bulletin boards. A kindergarten tutoring program was begun to get older children into the habit of telling and reading stories to younger children.

Parallel with the languaging procedures for collecting, processing, and utilizing information were the non-verbal collecting, processing and utilizing procedures. Graphic representation and three-dimensional construction encouraged the child to put together relationships. A child's drawings and models were considered visual hypotheses or generalizations, non-verbal statements of meaning which were just as acceptable and legitimate as verbal hypotheses or generalizations.

A number of on-going yearlong activities were designed to help children process and utilize information in their surroundings. The digging of a compost heap in preparation for a spring garden plot was one activity begun in August and carried through to May. Groups of children daily gathered and spread dead leaves and grass, rotten logs, manure, and soil on the heap in layers. In spring the humus formed was used to fertilize a vegetable-flower garden. In fall the new class separated flower seeds from the dead flowerheads of last year's garden and bagged the seeds in anticipation of planting them next spring. Classroom pumpkins supplied the seeds for a spring pumpkin patch as well as seeds for the bird feeder and birds' garden and pulp for pumpkin pies to accompany school lunches. The compost heap with its decaying

and life supporting functions and the garden helped children "read" the cycles and changes to which they are intricately linked.

Three activities accrued from the study of the compost heap--sampling and profiling soils on campus, soil habitat construction, and the burial. Soil study on campus included collecting, profiling and experimenting with soil types. "Framing Filmstrips" was a close viewing procedure for focusing on a soil profile. For this activity a column of windows was cut into a sheet of flexible cardboard which was placed directly against the soil zone to be studied. Parallel to the column of windows, a column of writing frames was positioned. For each viewing window, the children wrote a brief observation or story, and in so doing formed an observational "filmstrip." The activity was extended to a series of observations including filmstrips describing "Layers of Soil in a Gully," "Layers of Soil on Terraced Farm Land," and "Layers of Soil in the Compost Heap." The technique emphasized the verbal mapping of the surface. The verbal map became part of the child's mental map that functioned as a probe for further readings. Graphic maps of the surface were made as well. Children experimented with making soil paint from the multi-colored soil samples. The experimentation led them back in time to Indian procedures for making soil paint and to present-day artists' paint-making techniques. The soil paint was used to make soil maps, murals of the schoolyard, and cave-like paintings. The clay gathered from the bank of the stream was used to form pottery which was sun-dried and painted to complement the rugs and mats woven in earlier activities.

The soil investigations and diggings led to unexpected finds. Buried artifacts from previous generations living in the area and from pre-historic Indian cultures were unearthed and treated as "evidence of" the past. The arrowheads and Indian paint pots found carried the children into a study of archeology. University archeologists and geologists served as resources as children pursued reading the earth.

Soil was studied as a habitat. Preposition language frames helped children capture things, happenings, and relationships "on the soil," "in the soil," "under the soil," and "above the soil." Soil habitats were re-constructed in the classroom giving children the responsibility for maintaining displaced plants and animals. The children had the opportunity to see themselves as affectors and directors of habitat survival. Through continued encounter and study of small-scale life systems like a soil habitat, hopefully,

they will develop a concern to maintain large-scale life systems from their home to the whole planet. The ground work for residential and city planning may begin with a child's vision of his classroom terrarium as "Toad City."

The burial activity involved the perception of factors contributing to decay over time and the observation of soil formation. Dead snakes and toads were abundant. Before the object was buried, children described its color, size, shape, and parts on a chart. This original chart was used as a basis for comparison in subsequent weeks. At weekly intervals the object was exhumed and the changes recorded. When the remains of the object were no longer visible, the humus formed was used in the plant hospital.

The plant hospital was a project designed to develop responsibility for living things along with continued monitoring of change and occurrence. Each child acted as a nurse to an ailing or convalescing plant patient. Activities included feeding, washing, pruning, transplanting, propogating, experimenting, sketching, and diary keeping. Nurses were on call to other classrooms throughout the school to advise on plant ailments and care.

In spring the plant hospital team moved outdoors to design and stock flower beds around the school with seedlings started indoors and with flowers from the compost heap garden. Come fall, the new class arranged the mature flowers in classroom bouquets and made corsages for visiting parents at open house.

The ancient loblolly pine tree outside the classroom window was an object of continuous study. To acquaint the children with the tree at the beginning of the year, texture rubbings of bark and needles were made by each child and combined into class books about the pine tree. A loblolly string dictionary containing the words read from the tree was strung by each child. As additional information was observed, the new words were added to the dictionaries. Children hugged the tree and chanted their pine tree words to the tree. Phrases of their chants were combined into verses for a loblolly pine tree song which was sung beneath the tree. Verbal and non-verbal form and function studies of the cone and its parts were made. A giant painting and story book was made of the tree similar to the book made during the study of grass. To encourage investigation and experimentation the language frame "What happens when . . . " was employed with situations involving the seed or cone: What happens when a winged pine seed leaves its mother cone? What happens

when a dry pine cone gets a water bath? What happens when a wet pine cone is placed in the sun?

The study of the behavior of birds was another ongoing activity. Birds supplied a continuous flow of data that helped children acquire habits of concentrated focus and interest. The first week of school children built a platform feeder outside the classroom window. The dependency relationship between man and wildlife can be learned through the yearlong feeding of birds. Attracting, maintaining, and sustaining birds are action patterns that bring immediate results from the child's efforts, thereby enabling him to realize the significance of his actions in the environment. As bird visitors increased, a bird sketchers club was chartered and each child kept a portfolio of paintings.

Recording information about birds took a variety of directions. The comic strip format of sequence frames combining verbal and graphic expression enabled children to record the habits and life styles of birds in a highly appealing medium for children. A monthly bird newspaper published by the children offered a variety of reporting assignments: bird sports, bird food editor, bird accidents, bird territory disputes, weather, bird houses for rent, and comics. The newspaper stories became the basis for a radio program broadcast to peers. The behavior of the teacher's live parrots was captured through photography and children designed slide-audio programs about the pair of birds.

Christmastime became a celebration for the birds. Near the wooden feeder a pine tree was decorated with suet balls and sandwiches, peanut buttered pine cones, cranberry-apple rings, raisin-cheese chains, popcorn strings, and grapefruit and orange-peel cups holding seeds. Recipe menu cards were written and compiled into a book of bird recipes sent home to parents.

Occasions arose when live birds were housed in the classroom for study and care. Abandoned naked fledglings that had fallen from nests were mothered by the children until feathers and strength took them away. An old wounded barred owl perched on a log in the classroom for a week while children questioned the owl using question language frames. Questions not answered by observation were asked of the wildlife officer invited to the classroom to inspect the bird. Each child sketched and painted a life-size portrait of the owl; another giant book emerged. When live birds weren't available for study, dead specimens or mummified birds were examined closely in verbal and nonverbal form and function lessons. Children became familiar with South Carolina

bird artists and their procedures for studying birds. A trip to the Columbia Art Museum to view an exhibit by wildlife artists in South CArolina increased enthusiasm for production of sketchings and experimental techniques when back in the classroom.

Lessons were designed to encourage the children to treat the surroundings as providing clues to new information. Bird walks, bird counts, bird song recording sessions, and nest study were in the field evidence hunts. In winter vacated nests were examined as to location and composition for clues to ownership. In spring nest building and caring for young were observed and recorded in photographs, comic strips and cycle books. Bird houses and shelters were designed, built, and located outdoors to attract particular species. Regular bird counts led to the discovery of bird territories. By recording bird calls while viewing the contexts in which they were made, children learned to distinguish the meanings of various calls.

Classroom housekeeping amid the activity was maintained on a daily basis through a series of room jobs held by each student. A spirit of cooperation was engendered since the completion of most activities required coordination of effort.

The compost heap, plant hospital, pine tree study, and bird observation were long term activities. The yearlong study of phenomena has several advantages. Extended study makes the child aware of the nature of inquiry as an unending pursuit. Furthermore, a sense of wonder develops through continuous discovery over time. Long term study allows for practice in utilizing language frames for processing information. The introduction of methods of inquiry must be afforded opportunities for practice at school so that habits will develop that extend beyond the school situation.

The foregoing overview of the classroom program illustrates how phenomena within the everyday life experience of the child became the reading content for an intermediate grade level Environmental Reading Program.

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